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Kuipers, Theo A.F.

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Theo A. F. Kuipers

WHAT IS THE BEST EMPIRICALLY EQUIVALENT THEORY?

REPLY TO IGOR DOUVEN

Douven's paper certainly is a very constructive one relative to ICR. It supports my turn to "inference to the best theory" (IBT) as a critically revised version of the standard rule of "inference to the best explanation" (IBE), it argues for an important refinement of IBT, and it shows ways of empirically testing it. I have nothing to criticize in the main argument, but I would just like to make some local remarks. But let me start by remarking that Igor Douven (1996) introduced the important notion of an OUD shift, that is, a shift in the Observable/Unobservable Distinction. It helped me a lot in clarifying the long-term dynamics of scientific research as described in ICR. Specifically, in Section 9.2.2., I first discuss in general what arguments can be given for specific and general, separate and comparative reference claims. I then deal with theoretical arguments, followed by experimental and then combined ones. Finally, I deal with the consequences of the acceptance of specific reference claims together with experimental and/or theoretical criteria for applying them, that is, when an OUD-shift has taken place. In this reply I first indicate how theoretical virtues of theories can be taken into account within my general approach. I then indicate what I like to call the "referential Douven test."

Theoretical Virtues

At the end of Section 3 Douven pleads for taking "theoretical virtues" into account in evaluating the merits of theories, in particular when the theories to be compared are empirically equivalent. He rightly remarks that I have studied this problem more recently, see (Kuipers 2002), with special emphasis on aesthetic virtues or, more precisely, "nonempirical features which (certain) scientists (have come to) find beautiful, that is, to which they ascribe aesthetic value" (Kuipers 2002, p. 299). Let me quote the abstract of that paper:

In this article I give a naturalistic-cum-formal analysis of the relation between beauty, empirical success, and truth. The analysis is based on the one hand on a hypothetical

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variant of the so-called ‘mere-exposure effect’ which has been more or less established in experimental psychology regarding exposure-affect relationships in general and aesthetic appreciation in particular (Zajonc 1968, Temme 1983, Bornstein 1989, Ye 2000). On the other hand it is based on the formal theory of truthlikeness and truth approximation as presented in my *From instrumentalism to constructive realism* (2000).

The analysis supports the findings of James McAllister in his beautiful *Beauty and revolution in science* (1996), by explaining and justifying them. First, scientists are essentially right in regarding aesthetic criteria useful for empirical progress and even for truth approximation, provided they conceive of them as less hard than empirical criteria. Second, the aesthetic criteria of the time, the “aesthetic canon,” may well be based on “aesthetic induction” regarding nonempirical features of paradigms of successful theories which scientists have come to appreciate as beautiful. Third, aesthetic criteria can play a crucial, schismatic role in scientific revolutions. Since they may well be wrong, they may, in the hands of aesthetic conservatives, retard empirical progress and hence truth approximation, but this does not happen in the hands of aesthetically flexible, “revolutionary” scientists.

For critical commentaries on this paper I refer the reader to the contributions by Miller (this volume) and Thagard (the companion volume). Here I shall merely focus on the formal point of the paper, according to which “more truthlikeness,” besides being empirically at least as successful, entails sharing at least as many nonempirical features with the true theory, as far as “distributed” features are concerned, that is, features that hold for all relevant models. Hence, if we have reasons to assume that the (strongest) true theory has certain nonempirical features, such features may guide theory choice aiming at truth approximation. Quoting the introduction of the paper, with some insertions, I claim:

... an aesthetic success [or, more generally, a theoretical success] can be just as good a signpost to the truth as an extra case of explanatory success, albeit in a more modest degree. The relevant difference is that the justified desirability of such an explanatory success can be more reliably established than that of an aesthetic [theoretical] feature, which is why the latter should be approached with more care.

Hence, I would like to claim that the paper on beauty essentially answers Douven’s implicit question, as far as “distributed” virtues are concerned, when he writes: “In whatever precise way theoretical virtues are going to play a role in comparing the goodness of theories, I shall henceforth assume IBT to operate on the basis of a definition of ‘best theory’ that takes these virtues into account in some formally and intuitively acceptable way.” (p. 292) Unfortunately, I have not presented that paper in terms of IBT. However, in these terms, the amended IBT would at least include the subrule that of two empirically equivalent theories the theoretically more successful one should be chosen, for the time being, as the closest to the truth. As an aside, in response

to Note 9, this implies that Douven's argument against speaking of "the best explanation," instead of "the best theory," would disappear. However, my own argument, according to which it sounds problematic to leave (very much) room for the possibility that the best explanation is already known to be falsified, remains valid.

The Referential Douven Test

The above suggested (partial) emendation of IBT immediately implies that I do not agree with Douven's claim in Note 12, in which he suggests that such a subrule has no justification in terms of truth (approximation), for which reason he focuses in Section 4 on the empirical justification of the amended IBT. To be sure, I would like to agree with Douven's point at the beginning of Section 4.1 that realists have to justify more than, to use his term borrowed and adapted from Psillos (1999), horizontal inference to the best theory. The latter rule corresponds to the observational version of the three versions of IBT that I distinguish (ICR, p. 228, see also Kuipers 2004 for a more detailed analysis): *Inference to the best theory on the observational/referential/ theoretical level (as the closest to the relevant truth)*. More specifically, entity realists have to justify in addition the referential version and theory realists the theoretical one.

However, empirical justifications, rightly advocated by Douven, must also have some relation to the truth approximation account. More specifically, whereas explanatory successes are based on (low-level) inductive generalizations or "object-induction," that is, induction of a regularity about (the behavior of) a certain kind of objects, theoretical successes are based on "meta-induction," that is, induction of a recurring nonempirical feature correlating with empirical success. Object-inductions are not very trustworthy, but they are certainly more trustworthy than meta-inductions. In a way, the bootstrap tests described by Douven must give an empirical justification of both types of induction, with the relevant differences, of course. However, it may well be that his tests are essentially tests of the methodological substrate of IBT, that is, the (also to be amended) rule of success (RS) (ICR, p. 114). In ICR (p. 227) I already suggested one particular form of such a test in relation to OUD and OUD shifts mentioned above: "Here it should be mentioned that an interesting test can be attached to the rationality of RS, which is a version of a test suggested by Douven (1996) and which we would like to call the Douven test. If most of our RS-choices on the basis of the old OUD, remain in tact after the OUD-shift, it suggests that RS is not only in theory, but also in practice, very fruitful for truth approximation." In particular, this outcome of

the (referential) Douven test would give empirical support to the referential version of IBT attached to RS, in addition to its theoretical support.

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